Ecology: The Biotic and Abiotic Environment

7-4 The student will demonstrate an understanding of how organisms interact with and respond to the biotic and abiotic components of their environments. (Earth Science, Life Science)

7.4.5 Summarize how the location and movement of water on Earth's surface through groundwater zones and surface-water drainage basins, called watersheds, are important to ecosystems and to human activities.
Taxonomy level: 2.4-B Understand Conceptual Knowledge

Previous/Future knowledge: In 1st grade students recognized water as part of the composition of Earth (1-4.1) and recognized the property that water will flow downhill (1-4.4). In 3rd grade Earth's water, saltwater and freshwater, features were identified and illustrated (3-3.2) and weathering, erosion, and deposition (by water) were illustrated as slow processes that change Earth's surface (3-3.8). During the study of the water cycle in 4th grade (4-4.1), runoff of water was identified as part of the process. High school Earth Science will continue the study of the movement of water on Earth's surface (ES-5.1) and illustrate the succession of river systems (ES-5.2). Karst topography as a result of groundwater processes is also in high school Earth Science (ES-5.3)

It is essential for students to know where water is, how it moves, and why it is important as an abiotic factor within an ecosystem. When water falls to Earth, some water soaks into the ground becoming part of groundwater. Gravity causes some of it to flow downhill as surface water instead of soaking into the ground; this is called *runoff*.

Groundwater
- Water that soaks into the ground. Soil and rock that allow the water to pass through is called *permeable*.
- The water enters into the *zone of aeration,* which is unsaturated. Groundwater will keep moving deeper into Earth until it reaches a layer of rock that is not permeable.
- The area where the water has filled all the space in the soil is called the *zone of saturation*; the top of this zone is the *water table*.
- Groundwater can also flow slowly through the underground rock or be stored in underground layers called *aquifers*.
- Groundwater is naturally purified as it soaks through the soil layers.

Surface-water
- Runoff that has not soaked into the ground. As runoff travels downhill, it forms the water in streams and rivers.
- An area that is drained by a river and all the streams that empty into it, the tributaries, is called a *drainage basin* or *watershed*.
- A *divide* is the high ground between two drainage basins.
- By studying a map that contains rivers and marking all the tributaries of that river, the watershed area can be identified.

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The availability of water as groundwater or surface-water is important to the ecosystems in that area. Some examples are:

- Flowing water can erode the land in one location and deposit the sediments in another.
- The floodplain of a river may deposit sediment after heavy rains enriching the area with new soil needed for growing vegetation. This new soil is nutrient rich. Crops or natural vegetation grow well in it.
- The drainage basin provides the needed water for animal life also.
- Deltas may form where the river ends its journey into a still body of water like a lake or the ocean. A unique ecosystem forms in delta regions, like the Santee delta in South Carolina or the Mississippi delta in Louisiana.

Water is also important to human activities. Some examples are:

- Human beings are dependent upon water for survival, not only for drinking but for agriculture and industry as well.
- Dams have been placed along some rivers in order to produce hydroelectric power and to offer recreation in the lakes that form behind the dams.
- Lakes, rivers, and the ocean contain sources of food and minerals.
- Earth is 71% water with 3% freshwater. Since much of the freshwater is in the form of ice, very little is left as "usable" freshwater for humans.

It is not essential for students to know the development of river systems or the features that form along river systems. Students do not need to know about springs, geysers, or the different types of wells or how they function to provide water. Karst topography and the formation of deposits in caves or sinkholes are also not necessary. Glaciers, their movement and deposits, are not part of this indicator.

Assessment Guidelines:
The objective of this indicator is to *summarize* how the location and movement of water on Earth's surface are important to ecosystems and human activities; therefore, the primary focus of assessment should be to generalize major points about groundwater and surface-water and their importance to ecosystems and human activities. However, appropriate assessments should also require students to *compare* groundwater and surface water; *interpret* a diagram of groundwater zones; *illustrate* a drainage basin on a map; or *exemplify* ways that humans use water.